DOCUMENT RESUME

ED 357 083 TM 019 862

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TITLE Evaluating the Effects of Collaborative Efforts To Improve Mathematics and Science Curricula.
PUB DATE Apr 93
NOTE 8p.; Paper presented at the Annual Meeting of the American Educational Research Association (Atlanta, GA, April 12-16, 1993).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Classroom Observation Techniques; *College School Cooperation; Comparative Analysis; *Computer Assisted Instruction; *Curriculum Development; Educational Technology; Evaluation Methods; High Schools; Interviews; Quasiexperimental Design; *Secondary School Mathematics; *Secondary School Science; Secondary School Teachers; Student Motivation; Videotape Recordings
IDENTIFIERS California State University Bakersfield; IBM California Educational Partnership Prog; *Kern Union High School District CA; Partnerships in Education

ABSTRACT

The Mathematics and Science Partnership Project (MSPP) is a 3-year collaborative effort among the U.S. Department of Education, IBM California Educational Partnership Program, California State University in Bakersfield (California), and the Kern High School District in Bakersfield (California) to impact mathematics and science curricula through the implementation of innovative technology. Thirteen teachers at six high schools have been provided with state-of-the-art computer networks and multimedia workstations, as well as mathematics and science software and training in implementing this technology. Some results of this effort are presented, following the first 2.5 years. Various evaluation methods have been used, including teacher journals, classroom observations, videotaping, questionnaires, student interviews, and a quasi-experimental comparison (not yet complete) of students using the technology with a group without access to the technology. The impact on teaching and learning has been documented. Teachers are using a more student-centered approach, and using more cooperative learning groups. Student motivation is improved, and students are enthusiastic about the technology. Implications of this collaborative effort are discussed. One table presents results of student surveys, and student interview questions are included. (SLD)

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Evaluating the Effects of Collaborative Efforts to Improve Mathematics and Science Curricula

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Paper presented at the Annual Meeting of the American Educational Research Association
Atlanta, Georgia

Session 52.30

April 16, 1993

TM019862

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Evaluating the Effects of Collaborative Efforts to Improve Mathematics and Science Curricula

Introduction and Objectives. The Mathematics and Science Partnership Project (MSPP) is a three year collaborative effort among the United States Department of Education, IBM California Educational Partnership Program, California State University, Bakersfield and the Kern High School District. The overall thrust of the project is to positively impact mathematics and science curricula via the implementation of innovative technology.

Thirteen teachers at six high schools within the Kern High School District located in Bakersfield, California were provided with "state-of-the-art" computer networks and multimedia workstations within their classrooms. These teachers were also provided with a variety of mathematics and science software/hardware packages as well as with extensive inservice training focusing on the implementation of this technology.

California State University, Bakersfield provided faculty from a variety of disciplines to work as consultants on this project in order to collaborate with the classroom teachers on the development of mathematics and science curricula.

The actual goals and objectives of the project not only focus on the improvement of curricula, but also on: increasing parent involvement; serving underrepresented students including females and ethnic minority students; and working with students who have limited English proficiency. In addition, the project focuses on teachers collaborating together to develop cross-subject integration of lessons.

The objective of this paper/presentation is to share some of the results of these efforts following the first two-and-a-half years of the project. Evaluation methodologies will be described and the actual outcomes on the teaching/learning process will be detailed.

Perspectives. The evaluation of the MSPP has been participant-based and information-based. Teachers, consultants and administrators were provided with the opportunity to suggest various methodologies for successfully evaluating the project. Since many of the project teachers had diverse goals specific to their own classrooms, it was important to used this participant-based model of evaluation.

Evaluation of the project was both formative and summative. The formative aspect included having the evaluation team provide ongoing suggestions to the project leadership in order to enhance the project towards achieving its stated goals and objectives. Evaluators served as liaisons between the project teachers and project leadership and university consultants by articulating the specific needs and concerns of the teachers. The summative evaluation of the project is discussed in the following section focusing upon methodology.

Methods, Techniques,and Data Sources. Throughout the first two years of the project a variety of techniques were employed in order to attempt to ascertain the effects that the technology was having on the teaching/learning process. The second important task in the evaluation was to attempt to determine if the project was successfully addressing its stated objectives.

Teachers kept ongoing journals documenting their activities, reactions and concerns. Teachers were also frequently observed and videotaped during actual classroom instruction. Teachers were also interviewed individually and in small groups according to their subject areas. Each year they also completed end-of-the-year questionnaires.

Another evaluation methodology employed was to dialogue with and question students focusing on their reactions to the technology. All of the students within the project teachers' classes also completed several written surveys. As well, student attendance data was examined.

During the final year, a quasi-experimental designed was used at one school site where students were compared among chemistry classes who had access to the technology compared with chemistry classes who did not have the technology available. The teachers for these classes were the same in an effort to control for teacher effects. The data from this study has not been completely collected and analyxed at this point. However, the data does include grades, test scores, laboratory report grades and attendance data. The final analysis of this data will occur in June, 1993.

Various lessons and products created by the teachers were also collected, analyzed and evaluated. As well, teachers kept portfolios of students' work which was also assessed. Finally, school site administrators, project leadership and university consultants were also interviewed and asked to complete questionnaires.

Results. Although analysis of some of the data is still ongoing, much of the data has been analyzed. A triangulation approach was utilized in order to arrive at the following conclusions. First, the technology has had an important impact on the teaching/learning process. The data indicates that teachers have changed the way they are teaching as a result of having the technology available to them. Teachers are using a much more student-centered approach to their teaching. They are lecturing less and are using cooperative learning groups more often than prior to the implementation of the technology.

Teachers have more time to work individually or in small groups with the students. This has led to improved teacher-student communication and has resulted in improved relationships between the teachers and their students. There has also been an increase in student-to-student interaction and communication.

Another important result is increased student motivation (see attached survey results). This improvement in motivation is manifested via increased class attendance, more completed assignments, and an increase in the number of students coming into the classroom before and after school and during their lunch periods in order to work with the technology.

Teachers report the technology has enabled students to actually "do" more science as opposed to simply reading about it. Data collected during the science experiments, particularly when using the Personal Science Laboratory (PSL), is more accurate and easier for the students to organize and analyze. This has led to improved student products. One teacher stated "the worst lab report this year is better that the best lab report from last year".

The technology has, in several ways, leveled the playing field for students who are at-risk or who, in the past, have had difficulties in the classrooms. The available technology has enabled these students to construct products equal in quality to the better students. In mathematics classes it has freed students from "the tyranny of mathematical calculations". Along with this freedom is an increase in focus upon students' problem solving and critical thinking skills.

In summary, the technology provided to these mathematics and science teachers has had much positive impact on the students and teachers. Both students and teachers believe that the technology has made their

classrooms more dynamic, exciting, and interesting places to be. The technology has also made learning easier for the students and improved their attitudes toward learning and school in general.

Implications. The evaluation of this project demonstrates that collaborative efforts among government agencies, private corporations, a university and a school district can have significant positive effects upon what is happening within the classroom. Executives from IBM have reacted very positively to the efforts of the teachers and university consultants and are excited about what they see happening within public school classrooms.

Another important implication is in knowing that change can occur rather rapidly when resources and commitment are in place. Within a very short period of time, dynamic changes have occurred within classrooms which have a high percentage of minority and at-risk students. The results of the first two years of this project demonstrate that there is much hope for the future of education in the United States, despite the many difficult obstacles which are encountered. Certainly the MSPP provides others with a model of success in attempting to bring about significant change within our schools.

Table 1 : Results of Student Surveys

strongly agree	agree	not sure	disagree	strongly disagree
1. I enjoyed using the technology within this class during the past year.				
23.8%	58.9%	12.5%	3.2%	1.2%
combined= 72.7%			combined= 4.4%	
2. I believe that the use of the technology helped me to better understand the information in this class.				
18.2%	52.3%	18.8%	7.9%	2.7%
combined= 70.5%			combined= 10.6%	
3. I was more motivated toward this class as a result of being able to use the technology.				
16.8%	43.4%	25.4%	11.5%	2.8%
combined= 60.2%			combined= 14.3%	
4. The technology used in this class was easy to use.				
20.4%	53.9%	16.1%	7.8%	1.4%
combined= 74.3%			combined= 9.2%	
5. Use of the technology in this class made the class more interesting to me.				
25.3%	47.2%	16.9%	8.1%	2.4%
combined= 72.5%			combined= 10.5%	
6. The use of the technology in this class improved my ability to learn.				
15.7%	48.7%	21.8%	9.5%	3.6%
combined= 64.4%			combined= 13.1%	

INTERVIEW QUESTIONS FOR MSPP TEACHERS

1. What were your most important accomplishments during this past year related to your participation in the MSPP?

2. How has your participation in the project changed the way that you teach or the way you evaluate students?

3. What effect has the technology within the project had on your students? Has it effected student motivation, achievement, or understanding? What new skills have your students learned?

4. How have your students reacted/responded to the technology implemented with the MSPP?

5. Approximately how much time did each student spend interacting with the technology within the MSPP?

6. What were the problems which you encountered related to your participation in the MSPP?

7. What additional comments do you have about the MSPP? Has the project been effective, successful, worth your time and energy?